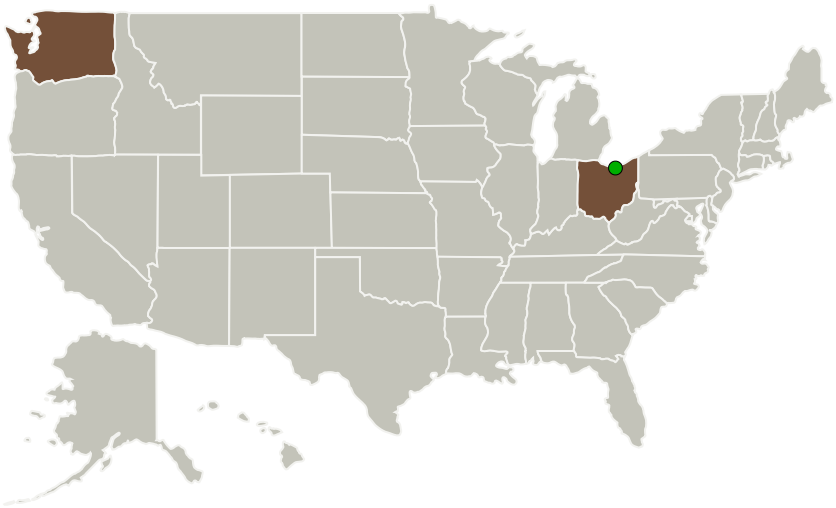
SWIFT-HPX - High Data Rate Ka-band Commications for Small Satellites, Phase I

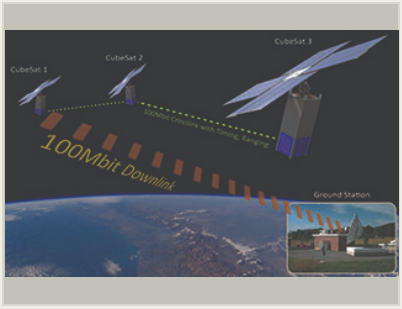
Completed Technology Project (2013 - 2013)

Project Introduction

Leveraging TUI's SWIFT software defined radio (SDR) architecture, we propose to develop a 100 Mbps downlink and intersatellite crosslink capability with ranging and timing synchronization capabilities to enable more sophisticated CubeSat and small satellite missions. This effort will focus on designing a Ka-band communications solution including a high-gain patch antenna array and Ka-band RF front end, that can be integrated with TUI's SWIFT software defined radio (SDR) processor running state-of-the art modulation and coding techniques to provide a robust link with adaptive data rates up to 100Mbps. Analyses indicate that a 100 Mbps crosslink can be closed between two CubeSats separated up to 100 kilometers and between a CubeSat in low-Earth orbit and a 12 meter dish (99% link availability with the ITU-P618 rain model) with the same radio. These links represent nearly two orders of magnitude of data throughput improvement over the rates achieved by CubeSat missions to date. This increased downlink and crosslink data rate will enable nanosatellites and CubeSat constellations to be used for scientific, commercial and operationally relevant remote sensing and earth observation missions. Adaptive modulation and coding makes the link more robust and allows for reduced data rate operations without increasing aperture sizes at greater distances (e.g. Lunar and Martian). The proposed SWIFT-HPX radio technology and resultant product supports the migration of small satellite and CubeSat near-Earth communication downlinks and crosslinks to higher frequency links, which is consistent with Phase 1-3 of NASA'S Space Communication and Navigation (SCaN) Program.

Primary U.S. Work Locations and Key Partners





SWIFT-HPX - High Data Rate Ka-band Commications for Small Satellites

Table of Contents

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
Tethers Unlimited Inc	Lead Organization	Industry	
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Ohio	Washington

Project Transitions

May 2013: Project Start

November 2013: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138531)*

Images

Project Image
SWIFT-HPX - High Data Rate Ka-band Commications for Small Satellites
(https://techport.nasa.gov/image/134545)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Tethers Unlimited Inc

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Nestor Voronka

Co-Investigator:
Nestor R Voronka

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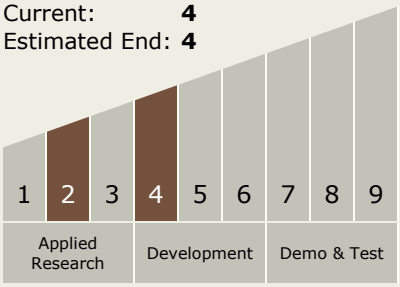
Completed Technology Project (2013 - 2013)

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - TX05.2 Radio Frequency
    - TX05.2.1 Spectrum-Efficiency

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System